University of Technology, Sydney

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Developing Computer Controlled Laser Systems for Double Blind Acupuncture Trials

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Certificate of Authorship and Originality

I certify that this thesis has not been previously submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also verify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged.

In addition, I verify that all information sources and literature used are indicated in the thesis.

Cameron Rogers

Signature of Candidate

Acknowledgement

Writing this thesis has been a long project, longer than I had originally expected, as with life things don't always go as planned. The loss of my greatest mentor, my mother Prof. Carole Rogers occurred during this project. Losing Carole was a severe loss in more ways than one, not just for me but for the University and the Acupuncture profession as a whole. My promise to Carole to see this out became one of my major motivations to keep going, even though without her the task seemed impossible at times. Therefore I dedicate this work to her memory.

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Abstract

Title: Developing Computer Controlled Laser Systems for Double Blind Acupuncture Trials

Background: Double blind clinical testing is considered critical for advancing most areas of medical research. Much of the acupuncture laser and Low Level Laser Therapy (LLLT) research lacks double blinding and suffers from poor trial design. While some research studies have shown a potential increased clinical effect in visible wavelength laser trials visible wavelength lasers are generally overlooked in research, due to the difficulties with double blinding.

Objectives: This study sought to design, construct and test a system that could randomise, control, monitor and record the delivery of visible laser in real-time, and allow for double blinding.

Method: The study utilised a novel approach to incorporate computer controlled lasers within opaque hoods. An optical sensor feedback was incorporated to objectively measure the delivery of laser in a double blinded randomised controlled trial (RCT) situation.

The equipment was designed and tested for future researchers to operate with a minimum of training.

The initial testing was designed around a *proof of concept* study using the equipment to stimulate Pericardium 6 (PC 6) with a visible (635 nm) 10 mW laser while monitoring changes in Heart Rate Variability (HRV). We only sought to trial the equipment under laboratory conditions to see if a double blind condition could be achieved. It was beyond the scope of this study to undertake a RCT of the effects of PC 6 on HRV.

Results: The equipment was successful in maintaining double blind conditions. Laser was delivered and monitored in real-time, the operational parameters were recorded and test participants reported no discomfort associated with the use of the equipment. The

computer successfully controlled the random delivery of laser. The test participants and operators were at no time aware of the state of the laser. The operators reported no difficulties in using the unit.

Conclusion: A laser research tool was successfully created and the study demonstrated the system's unique ability to overcome all the difficulties identified for visible laser wavelength double blind research.

The system is currently designed with two laser hoods to allow for bilateral acupuncture point testing. Future improvements could include additional laser hoods for multiple acupuncture point treatments. Construction of alternate hoods would allow for testing of different wavelengths including infrared and different laser power levels.

The system combines double blind testing with physiological monitoring, which allows researchers to record the physiological effects that accompany laser therapies.